Section A.

Technical Notes

Scope of the Survey

Data for the National Science Foundation's (NSF's) fiscal year (FY) 1996 report on research and development (R&D) expenditures were collected from 493 institutions of higher education in the United States and Outlying Areas. These institutions were selected from the universe of 674 schools that have doctoral programs in science and engineering (S&E), are historically black colleges or universities that expend any amount of separately budgeted R&D in S&E, or are other institutions that expend at least $50,000 in separately budgeted R&D in S&E.

In addition, the survey includes 18 federally funded research and development centers (FFRDCs). To qualify, an FFRDC must be engaged in basic or applied research, development, or management of R&D activities, and the results of these activities must be directly monitored by the Federal Government—usually a single agency—in a relationship expected to be maintained on a long-term basis. The center must be operated, managed, and administered by either a university or consortium of universities as an autonomous organization or as an identifiable separate operating unit of its parent institution. Finally, 70 percent or more of the center's financial support must be received from the Federal Government.

Although the same survey form (NSF Form 411) is used to collect data from both academic institutions and FFRDCs, the resulting data are presented separately in this report. The survey population was reviewed prior to mailing the questionnaires to ensure that each institutional classification was accurate. Characteristics of the schools were reviewed before and during the course of the survey to determine if changes had occurred (i.e., in highest degree granted or in terms of school openings, closings, or mergers).

Survey Instrument

Most major R&D performers have incorporated into their recordkeeping systems the data that are essential to complete this survey, thereby ensuring a consistent format from one year to the next. Such consistency yields the most useful statistics for time series. As a rule, information to complete this questionnaire is found within the institutions' year-end accounting records.

The survey questionnaire consists of four main items:

Item 1 is a request that institutions report their total current expenditures for separately budgeted science and engineering R&D for all activities specifically organized to produce research outcomes and commissioned by an agency either external to the institution or separately budgeted by an organizational unit, i.e., research centers, within the institution by source of funds. In addition, schools are asked to provide the percentage of the total and the federally financed expenditures that are considered basic research. Included also are research funds for which an outside organization, educational or other, is a subrecipient. Care should be observed when interpreting data on source of funds; for example, industry R&D support is limited to grants and contracts for R&D activities from profit-making organizations, and the total reported excludes research funded through unrestricted accounts and from corporate foundations, endowments, and fellowships to students. An increasing number of institutions have linkages with industry and foundations via subcontracts, thus complicating the identification of funding source. In addition, institutional policy may determine whether unrestricted state support is reported as state or as institutional funding.

Item 1A, first added in this FY 1996 survey, is a request for total and federally financed current fund expenditures for separately budgeted science and engineering R&D passed through the institution to subrecipients. Schools were asked to break out the subrecipient category by "educational" and "other."

Item 2 is a request for total and federally financed current fund expenditures for separately budgeted R&D activities by detailed S&E fields. Major fields remain unchanged from the FY 1994 questionnaire. When interpreting these data at the detailed discipline level, users should keep in mind that there is considerable interdisciplinary activity and/or overlap among subdisciplines.

Item 3 is a request for the portions of total and federally financed expenditures reported in items 1 and 2 that were used for the purchase of research equipment out of current funds. This portion includes all research equipment purchased under sponsored research project awards and disbursed in the same

detailed disciplines as in item 2. These data are of special interest to Federal and institutional policymakers in determining current funding levels for scientific research instrumentation.

ITEM 1A ANALYSIS

Because the responses to this item are not published in any of the Detailed Statistical Tables, a summary is presented here and in the following table. This item was completed by 88 percent of the respondents. The total R&D expenditures to subrecipients, $770 million, represented 3.8 percent of the item 1A respondents' total R&D expenditures. The doctorate-granting institutions reported a slightly higher percentage of pass-through funds than did the non-doctorate-granting institutions. Item 1A respondents from doctorate-granting institutions reported $762 million, or 3.8 percent, of their total R&D expenditures were passed through to subrecipients, versus $7.9 million or 3.4 percent of item 1A non-doctorate-granting respondents. Item 1A respondents from private institutions reported a higher percentage (5.7 percent) of pass-through funds than those from public institutions (3.0 percent). Respondents to this question reported $628 million of Federal R&D funds¾ or 4.6 percent of their $13.6 billion Federal support total was passed through to subrecipients.

FY 1996 Item 1A Summary for Total Academic R&D Expenditures

(Dollars in Thousands)

Degree and Control	All Respondents Survey R&D	Item 1A Respondents' Total R&D	Total R&D Expenditures Subrecipients		
			Educational	Other	Total*
All institutions	22,665,305	20,286,543	369,351	194,023	769,961
Doctorate	22,406,622	20,055,271	362,996	192,506	762,089
Non-doctorate	258,683	231,272	6,355	1,517	7,872
Public	15,291,986	14,402,207	233,500	144,036	437,418
Private	7,373,319	5,884,336	135,851	49,987	332,543

* Some respondents could not break total down into sectors.

FY 1996 Item 1A Summary for Federal Academic R&D Expenditures

(Dollars in Thousands)

Degree and Control	All Respondents Federal R&D	Item 1A Respondents' Federal R&D	Federal R&D Expenditures Subrecipients		
			Educational	Other	Total*
All institutions	13,593,513	12,097,625	324,730	191,943	628,446
Doctorate	13,424,103	11,945,083	318,605	190,502	620,880
Non-doctorate	169,410	152,542	6,125	1,441	7,566
Public	8,256,972	7,879,021	201,281	146,425	367,610
Private	5,336,541	4,218,604	123,449	45,518	260,836

* Some respondents could not break total down into sectors.

Response Rate

The FY 1996 survey questionnaires were mailed in January 1997. Every effort was made to maintain close contact with respondents in order to preserve both consistency and continuity in the resultant data. Questionnaires were carefully examined for completeness upon receipt. Computerized facsimiles of the survey data were then prepared for each institution, comparing the current and 2 prior years' data and noting any substantive disparities. These facsimiles were mailed to the respondents so that they could provide revisions before final processing and tabulation of the data.

Respondents were asked to explain significant discrepancies between current and prior years' reporting patterns previously verified as correct. They were encouraged to correct prior years' data if anomalies were identified. When updated or amended figures covering past years were submitted, trend data were correspondingly changed by NSF. Similarly, if a respondent institution underwent an organizational change, such as a merger, NSF incorporated the effects of such changes into prior years' data.

By the survey closing date in mid-July, forms had been received from 480 universities and colleges out of the academic sample population of 493, resulting in a 97.4-percent response rate. Responses were received from 97.7 percent of all doctorate-granting institutions, where 97.8 percent of the estimated national R&D expenditures in S&E fields were disbursed. Also, forms were received from 17 of the 18 FFRDCs. Tables A-1a and A-1b display a detailed breakdown of the response rates by highest degree granted and by sampling stratum (defined later in this section under "Sampling, Weighting, and Standard Errors of the Estimates").

National Total and Imputation

To provide a national estimate for all universities and colleges performing R&D in FY 1996, it was necessary to implement three statistical procedures. First, data were estimated by "imputation" for the 3 percent of the sample population that had not responded by the closing date of the survey. Imputation has been used consistently since FY 1976. Second, data were also imputed for universities and colleges that submitted only partial responses. The imputed total, prior to weighting, was $83 million. Third, the sample total was weighted to compensate for those universities and colleges that were in the survey universe but not in the survey sample. (This procedure is described later under "Sampling, Weighting, and Standard Errors of the Estimates.") This process led to an inflation of $247 million in the national total of R&D expenditures at universities and colleges for FY 1996, resulting in a $22,995 billion total, as shown in table A-2. (The imputed total was inflated to $91 million, as noted in table A-2.)

Tables A-3a and A-3b present breakdowns of both the imputed amounts and the amount of the weighted inflator by broad S&E field. The dollar amount imputed is displayed along with the percentage it represents of the national estimate for universities and colleges in a particular field. Also given is the amount of the weighted inflator for that field. The amount imputed is similarly broken down by source of funds in table A-4.

A significant number of surveyed institutions have been responding only intermittently in past years, providing data one year, not responding for one or more subsequent years, and then providing data again. For the years in which no response was received, data have been imputed as previously described. Although the imputation algorithm accurately reflects national trends, it cannot account for reporting anomalies at individual institutions. For this reason a separate backcasting of prior years' data was performed, following current-year imputation.

For each institution, formerly imputed key variables for items 1 to 3 were compared with subsequent submissions to determine whether the imputed data accurately represent the growth patterns shown by reported data. Re-estimation was applied when the imputed data were not consistent with reported data. If data were reported for FYs 1993 and 1996 but not for the intervening years, for example, the difference between the reported figures for each item total was calculated and evenly distributed across the intervening years (1994–95). The new figures were spread across disciplines (items 2 and 3) or sources of support (item 1) on the basis of the most recent reporting pattern. A clean facsimile was generated for each of the institutions undergoing these procedures and returned to the school for comment. These procedures resulted in much more consistent reporting trends for individual institutions but had little effect upon aggregate figures reflecting national totals.

Data Anomalies

Aggregate academic expenditure data are generally consistent from year to year, although data for individual institutions may vary considerably. Data anomalies may reflect true increases or decreases in expenditures or may be the result of changes in reporting methodology.

Highest-Degree-Granted Tables

Several longitudinal tables display data for institutions whose highest S&E degree granted is at the doctoral level. In tables produced prior to FY 1992, it would have been difficult to identify whether changes in yearly R&D expenditures were caused by changes in expenditure levels or in the number of doctorate-granting institutions. In order to maintain a consistent group of institutions across all years, the highest-degree-granted status for each institution is based on the highest degree granted in the most recent year, FY 1996.

Sampling, Weighting, and Standard Errors of the Estimates

Full population surveys are conducted by NSF every five years. During intervening years, a sample of institutions is drawn and surveyed. Only universities and colleges are included in the sampling frame; all University-Administered FFRDCs are always surveyed. Since a full population survey was conducted in FY 1993, a new sample of institutions was drawn for the FY 1994 survey. This sample will be maintained and resurveyed for FY 1997; the next full population survey will be in FY 1998. Universities and colleges have been divided into the following four sampling strata (three certainty strata and one probability stratum):

(1) **A certainty stratum of doctorate-granting institutions.** This stratum contains 310 universities and colleges that have doctoral programs in S&E. Excluded from this stratum are all doctorate-granting historically black colleges and universities (HBCUs) and university-system campuses.

(2) **A certainty stratum of HBCUs.** This stratum includes all 65 HBCUs (including those that are doctorate-granting institutions or university-system campuses).

(3) **A certainty stratum of university-system campuses.** This stratum includes 56 "university-system campuses;" each sample entry is the aggregation of all campuses that make up a university system. Note that no HBCUs are included in this stratum even if they are university-system campuses.

(4) **A probability stratum of institutions that grant degrees at the master's level or below.** This stratum includes 62 master's or bachelor's degree-granting institutions and institutions that offer no S&E degrees at any degree level, out of a survey stratum universe of 243. Note that none of the universities or colleges included in this stratum is either an HBCU or a university-system campus. This stratum had a sampling ratio of 26 percent.

The data in this report are weighted to represent national-level R&D expenditures for universities and colleges (as mentioned previously under "National Total and Imputation"). The sample data, after imputation, were inflated to produce universe estimates by weighting the individual questionnaire data values by the inverse of the sampling ratio. Thus, in aggregating data for institutions from the probability stratum for tabulation purposes, each datum value was weighted by the inverse of the sampling ratio.

Estimates derived for institutions in the probability stratum were based on a sample, and the relative standard error (coefficient of variation) of an estimate was then obtained by dividing the standard error by the estimate itself, expressed as a percentage of the estimate.

The standard errors and coefficients of variation for each major S&E field are shown in table A-5. For example, for total academic R&D expenditures of $23 billion, the standard error of the estimate is $131.2 million at the 95-percent confidence level, with a coefficient of variation of ±0.6 percent. Similarly, for the estimate of $13.8 billion in federally financed expenditures, the 95-percent confidence limits are ± $60.6 million, with a coefficient of variation of ±0.4 percent.

Data Availability

Data published in this report are also available in machine-readable form on the World Wide Web. Single-year or multi-year data files are available with data for FYs 1975-96. Information on file formats and the years for which they are available can be found on the World Wide Web at URL *http://www.nsf.gov/sbe/srs/rdexp/95pubuse.htm*.

Selected data items for institutions are available on the World Wide Web *(http://www.nsf.gov/sbe/srs/profiles/start.htm)*. These profiles cover data from this survey as well as data collected in NSF's other academic S&E surveys: the Survey of Graduate Students and Postdoctorates in Science and Engineering (graduate student survey) and the Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions (Federal support survey). The profiles are also linked to the corresponding ranking table of each survey.

Institutional researchers can obtain data from several academic S&E resources through the Web Computer-Aided Science Policy Analysis and Research (WebCASPAR) database system, which is an easy-to-use tool for the retrieval and analysis of statistical data on academic S&E resources. WebCASPAR provides an extensive and growing data library with multi-year statistics on the state of higher education in general and on academic S&E resources specifically. This data library is based on a set of standard institutional and field-of-science definitions across the multiple sources used to develop the database. The WebCASPAR program includes built-in help capabilities to facilitate the use and interpretation of the data.

The latest version of WebCASPAR can now be accessed via the World Wide Web *(http://caspar.nsf.gov/webcaspar)*.

WebCASPAR data are drawn from a number of sources. All data are available for individual institutions, by state, and at the national level. Longitudinal data from surveys of universities and colleges conducted by the NSF's Division of Science Resources Studies include the academic R&D expenditures survey, the Federal support survey, and the graduate student survey. Data from the surveys of universities and colleges conducted by NCES include earned degrees, opening fall enrollment, faculty salaries, tenure and fringe benefits, and financial statistics.

SECTION A.

TABLES

SECTION A. TABLES

Table A-1a. Response rates for the academic research and development expenditures survey, by highest degree granted: fiscal year 1996

Highest degree granted	Number in survey universe	Number in sample population	Number of complete responses	Number of partial responses	Total number of responses	Response rate
Grand total	692	511	356	141	497	97.3
Universities and colleges total	674	493	339	141	480	97.4
Doctorate	343	343	236	99	337	97.7
Master's	203	84	64	17	81	96.4
Bachelor's and below	128	66	39	25	64	97.0
Academically-administered FFRDCs total	18	18	17	0	17	94.4

SOURCE: National Science Foundation/SRS, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1996

Table A-1b. Response rates for the academic research and development expenditures survey, by stratum and highest degree granted: fiscal year 1996

Stratum	Number in survey universe	Number in sample population	Number of complete responses	Number of partial responses	Total number of responses	Response rate
Grand total	692	511	356	141	497	97.3
Doctoral stratum 1/	310	310	215	90	305	98.4
HBCU stratum	65	65	37	24	61	93.9
Doctorate	11	11	5	5	10	90.9
Master's	17	17	13	2	15	88.2
Bachelor's and below	37	37	19	17	36	97.3
University system stratum	56	56	43	11	54	96.4
Doctorate	22	22	16	4	20	90.9
Master's	29	29	24	5	29	100.0
Bachelor's and below	5	5	3	2	5	100.0
Master's or below stratum 2/	243	62	44	16	60	96.8
Master's	156	38	27	10	37	97.4
Bachelor's and below	87	24	17	6	23	95.8
Academically-administered FFRDCs	18	18	17	0	17	94.4

1/ Doctoral stratum does not include doctorate-granting institutions that are recorded in either the HBCU or the university system stratum.

2/ Master's or below stratum does not include master's-granting institutions or bachelor's and no S&E degree granting institutions that are recorded in either the HBCU stratum or the university system stratum.

SOURCE: National Science Foundation/SRS, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1996

Table A-2. Imputed amounts for research and development expenditures at universities and colleges, by highest degree granted: fiscal year 1996

[Dollars in millions]

Highest degree granted	National estimate of separately budgeted R&D expenditures	Amount inflated due to weighting	Inflated imputed amount	Inflated imputed amount as percent of total
Total	22,995	247	91	0.4
Doctorate granting institutions	22,481	0	74	0.3
Non-doctorate granting institutions	515	247	17	3.3

NOTE: Because of rounding, figures may not add to the totals shown.

SOURCE: National Science Foundation/SRS, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1996

Table A-3a. Imputed amounts for research and development expenditures at universities and colleges, by science and engineering field: fiscal year 1996

[Dollars in millions]

Science and engineering field	National estimate of separately budgeted R&D expenditures	Amount inflated due to weighting	Inflated imputed amount	Inflated imputed amount as percent of total
Total	22,995	247	91	0.4
Engineering	3,675	22	57	1.6
Physical sciences	2,260	37	60	2.7
Environmental sciences	1,478	45	72	4.9
Mathematical sciences	289	7	11	3.8
Computer sciences	702	13	9	1.3
Life sciences	12,697	91	198	1.6
Psychology	372	5	12	3.2
Social sciences	1,104	20	38	3.4
Other sciences	419	6	6	1.4

SOURCE: National Science Foundation/SRS, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1996

Table A-3b. Imputed amounts for federally financed research and development expenditures at universities and colleges, by science and engineering field: fiscal year 1996

[Dollars in millions]

Science and engineering field	National estimate of separately budgeted R&D expenditures	Amount inflated due to weighting	Inflated imputed amount	Inflated imputed amount as percent of total
Total	13,810	128	94	0.7
Engineering	2,216	14	33	1.5
Physical sciences	1,639	23	37	2.3
Environmental sciences	994	22	50	5.0
Mathematical sciences	209	6	9	4.3
Computer sciences	509	8	8	1.6
Life sciences	7,389	38	110	1.5
Psychology	254	4	9	3.5
Social sciences	427	10	14	3.3
Other sciences	172	2	3	1.7

SOURCE: National Science Foundation/SRS, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1996

Table A-4. Imputed amounts for research and development expenditures at universities and colleges, by source of funds: fiscal year 1996

[Dollars in millions]

Source of funds	National estimate of separately budgeted R&D expenditures	Amount inflated due to weighting	Inflated imputed amount	Inflated imputed amount as percent of total
Total	22,995	247	91	0.4
Federal Government	13,810	128	94	0.7
State and local government	1,725	16	7	0.4
Industry	1,576	15	14	0.9
Institutional funds	4,232	67	28	0.7
All other sources	1,653	21	16	1.0

SOURCE: National Science Foundation/SRS, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1996

Table A-5. Standard errors of the estimates (SE) and coefficients of variation (CV) for research and development expenditures at universities and colleges, by science and engineering field: fiscal year 1996

[SE in thousands of dollars; CV in percent]

Science and engineering field	Separately budgeted R&D expenditures		Federally financed R&D expenditures	
	1.96 SE	1.96 CV	1.96 SE	1.96 CV
Total	131,232	0.6	60,553	0.4
Engineering	16,520	0.4	11,587	0.5
Physical sciences	16,122	0.7	11,183	0.7
Environmental sciences	34,640	2.3	18,458	1.9
Mathematical sciences	4,018	1.4	3,389	1.6
Computer sciences	10,651	1.5	6,884	1.4
Life sciences	83,722	0.7	23,673	0.3
Psychology	2,710	0.7	2,489	1.0
Social sciences	12,233	1.1	8,714	2.0
Other sciences	4,897	1.2	3,648	2.1

SOURCE: National Science Foundation/SRS, Survey of Research and Development Expenditures at Universities and Colleges, Fiscal Year 1996